PB-239 717

REPORT ON MATTAWAMKEAG LAKE, AROOSTOOK COUNTY, MAINE. EPA REGION I

Pacific Northwest Environmental Research Laboratory

Prepared for:

Maine Department of Environmental Protection
Maine National Guard

May 1974

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

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REPORT
ON
MATTAWAMKEAG LAKE
AROOSTOOK COUNTY
MAINE

EPA REGION I

WORKING PAPER NO. 8

WITH THE COOPERATION OF THE

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

AND THE

MAINE NATIONAL GUARD

MAY, 1974

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F O R E W O R D

The National Eutrophication Survey was initiated in 1972 as a research project in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations and impact on selected fresh water lakes as a basis for formulating comprehensive and coordinated national, regional and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations and impacts can, in fact, be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

This report documents the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin. It is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/ standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Maine Department of Environmental Protection for professional involvement and to the Maine National Guard for conduct of the tributary sampling phase of the Survey.

William R. Adams, Commissioner of the Department of Environmental Protection, and William P. Hinckley and Matthew Scott of the Division of Lakes and Biological Studies, provided invaluable lake documentation and counsel during the course of the study.

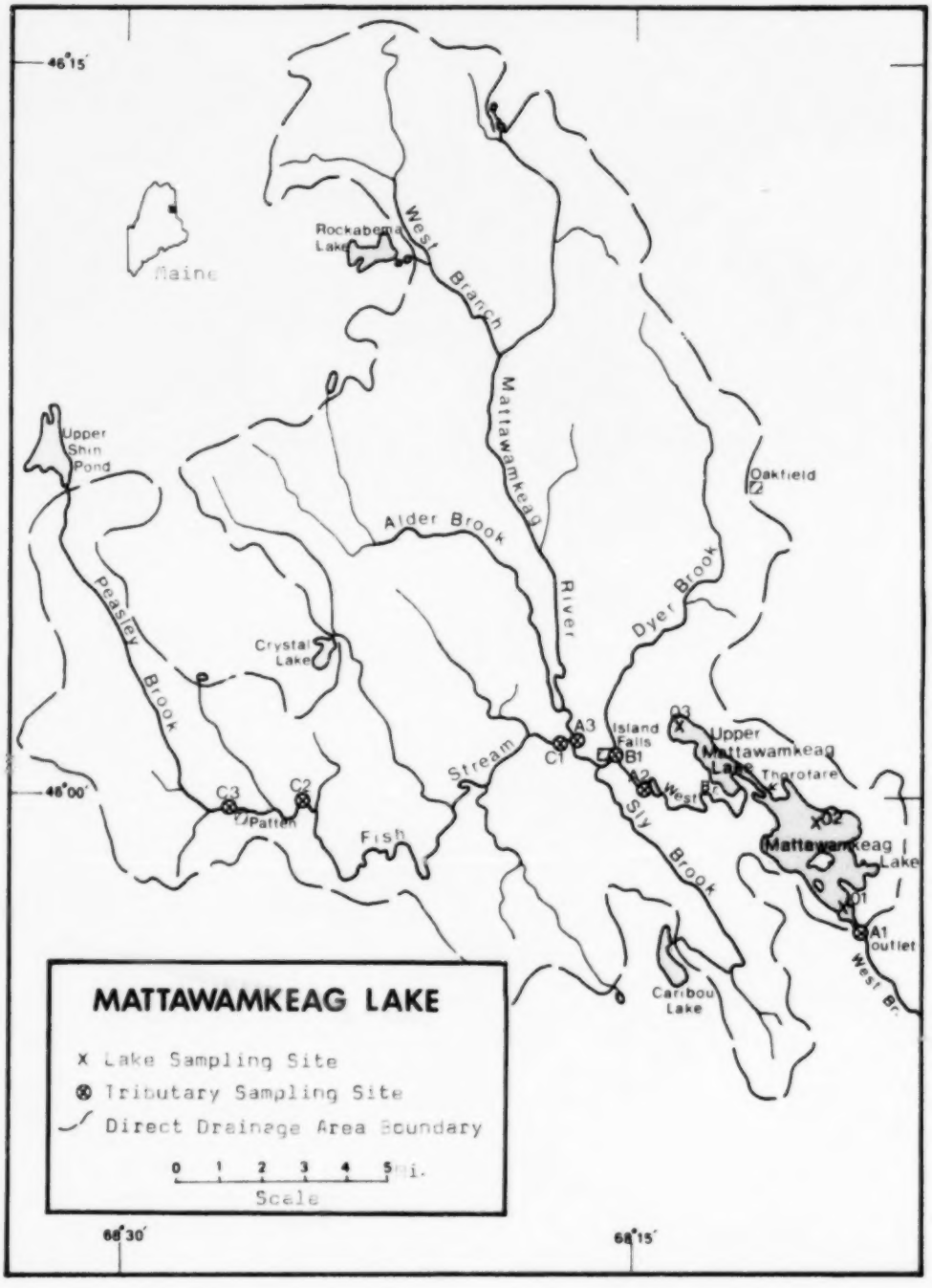
Major General Edwin W. Heywood (Retired), then the Adjutant General of Maine, and Project Officer Lieutenant Colonel Earl B. Adams who directed the volunteer efforts of the forty-one participating Maine National Guardsmen are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF MAINE

LAKE NAME	COUNTY
Moosehead Lake	Piscataquis, Somerset
Estes Lake	York
Long Lake	Cumberland
Bay of Naples & Sebago Lake	Cumberland
Rangeley Lake	Franklin
Long Lake	Aroostook
Mattawamkeag Lake	Aroostook
Sebasticook Lake	Penobscot


46°15'
Maine
Rockabema Lake
West Branch
Mattawamkeag River
Upper Shin Pond
Oakfield
Alder Brook
Peasley Brook
Crystal Lake
Dyer Brook
A3
C1
Island Falls
B1
Q3
Upper Mattawamkeag Lake
Thorofare
West Br.
A2
Stream
C3
C2
Patten
Fish
Sly Brook
Mattawamkeag Lake
Q2
Q1
A1 outlet
West Br.
Caribou Lake
46°00'
68°30'
68°15'
MATTAWAMKEAG LAKE
Lake Sampling Site
Tributary Sampling Site
Direct Drainage Area Boundary
0 1 2 3 4 5 mi.
Scale

MATTAWAMKEAG LAKE

STORET NO. 2308

I. CONCLUSIONS

A. Trophic Condition:

Low nutrient concentrations and chlorophyll *a* in conjunction with summer depression of dissolved oxygen in the hypolimnion signify a mesotrophic condition. This conclusion is confirmed by State of Maine authorities.

B. Rate-Limiting Nutrient

Because of a significant loss of nutrients, the algal assay results are not considered reliable. The lake data show that the lake was nitrogen limited at the time the assay sample was collected but phosphorus limited the other two sampling times.

C. Nutrient Sources; Controllability:

1. Point Sources - Provision of secondary wastewater treatment at the communities of Patten and Island Falls would result in sufficient phosphorus reduction to protect Mattawamkeag Lake, as indicated by a comparison of Survey data with the Vollenweider model.

2. Non-Point Sources - Areal contribution of primary nutrients is relatively low for phosphorus (42.4% of total P), while rather high for nitrogen (77.3% of total N).

II. INTRODUCTION

Mattawamkeag Lake is located on the West Branch of the Mattawamkeag River in Aroostook County. Although much of the drainage is forested, the area is noted for the production of potatoes, and at least one potato processing plant is located in the immediate drainage area.

Mattawamkeag is a relatively shallow warmwater lake and provides an excellent habitat for smallmouth bass, white perch, and chain pickerel. Reportedly, some salmon are taken during early spring fishing. Except for a few summer cottages, shoreline development is minimal.

Mattawamkeag Lake and Upper Mattawamkeag Lake are generally considered to be separate water bodies (see map, page v); however, the two are broadly joined, and the levels and patterns of physical and chemical parameters are similar in both. Therefore, in this report the two parts are treated as one water body.

Reportedly, the lake is consistently strongly humic colored with platinum scale values generally around 70 ppm. The color limits light penetration to a degree and may account in part for the quite low chlorophyll a measured during the Survey.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry:

1. Surface area: 3,330 acres.
2. Mean depth: 12* feet.
3. Maximum depth: 47 feet.
4. Volume: 39,960 acre/feet.
5. Mean hydraulic retention time: 42 days.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area†	Mean flow†
West Branch, Mattawamkeag River**	124.1 mi^2	193.0 cfs
Fish Stream	113.7 mi^2	177.0 cfs
Dyer Brook	34.0 mi^2	52.9 cfs
Sly Brook	22.2 mi^2	34.6 cfs
Minor tributaries & immediate drainage -	14.8 mi^2	26.6 cfs
Totals	308.8 mi^2	484.1 cfs

2. Outlet -

West Branch of Mattawamkeag River	314.0 mi^2***	484.1 cfs

* Calculated by random dot method.
** See discussion, page 10.
*** Includes area of lake.
† Drainage areas are accurate within ±1% and mean annual flows within ±5%.

C. Precipitation*:

1. Year of sampling: 40.6 inches.

2. Mean annual: 34.9 inches.

* See Working Paper No. 1, "Survey Methods".

IV. LAKE WATER QUALITY SUMMARY

Mattawamkeag Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from a number of depths at each station (see map, page v). During each visit a single depth-integrated (15 feet or near bottom to surface) sample was composited from the three stations for phytoplankton identification and enumeration; and, during the last visit, a single five-gallon depth-integrated sample was composited for algal assay. Also each time, depth-integrated samples were collected at the stations for chlorophyll a analyses. Maximum depths sampled were 14 feet at station 1, 28 feet at station 2, and 6 feet at station 3.

It should be noted that the Survey Secchi disc values are consistently less than those observed by the Maine Department of Environmental Protection. Such variations could be attributed to fluctuations in cloud cover or sun angle (ambient light conditions), observer technique, water surface disturbance, or may, in fact, be result of short-term water clarity differences.

Also in addition to greater Secchi disc values, personnel of the Maine Department of Inland Fisheries and Game report their total alkalinities and surface conductivities for Mattawamkeag Lake are generally somewhat higher than the Survey values.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

FALL VALUES

(09/28/72)

Parameter	Minimum	Mean	Median	Maximum
Temperature (Cent.)	13.5	14.5	14.8	15.0
Dissolved oxygen (mg/l)	8.5	9.0	9.0	9.7
Conductivity (µmhos)	63	64	64	68
pH (units)	7.1	7.1	7.1	7.2
Alkalinity (mg/l)	22	24	24	25
Total P (mg/l)	0.014	0.016	0.016	0.021
Dissolved P (mg/l)	0.010	0.011	0.011	0.012
NO_2 + NO_3 (mg/l)	0.030	0.031	0.030	0.040
Ammonia (mg/l)	0.050	0.074	0.070	0.110

ALL VALUES

Secchi disc (inches)	36	62	55	96

B. Biological characteristics:

1. Phytoplankton* -

Sampling Date	Dominant Genera	Number per ml
06/06/72	1. Dinobryon	111
	2. Synedra	53
	3. Asterionella	33
	4. Nitzschia	23
	5. Navicula	20
	Other genera	73
	Total	313
09/28/72	1. Flagellates	798
	2. Dinobryon	617
	3. Achnanthes	286
	4. Fragilaria	271
	5. Cyclotella	196
	Other genera	859
	Total	3,027

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
06/06/72	01	1.5
	02	2.0
	03	2.6
08/08/72	01	1.7
	02	2.0
	03	1.8
09/28/72	01	2.2
	02	2.7
	03	1.4

* One phytoplankton sample was lost in transit.

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.001	0.045	0.4
0.006 P	0.007	0.045	1.7
0.012 P	0.013	0.045	1.8
0.024 P	0.025	0.045	2.4
0.060 P	0.061	0.045	2.1
0.060 P + 10.0 N	0.061	10.045	36.4
10.0 N	0.001	10.045	0.4

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicated a low potential primary productivity in the sample at the time of assay. However, there was a loss of about 8 µg/l of dissolved phosphorus and 60 µg/l of nitrogen from the time the sample was collected to the time the assay was begun. Had these losses not occurred, the control sample would probably have supported a moderate yield of about 4 mg/l.

The assay sample appears to have been phosphorus limited; however, had the nutrient losses noted above not occurred, the sample probably would have shown nitrogen limitation (i.e., an N/P ratio of 11 or 12/1). Further, the N/P ratio in the lake was 10/1 when the assay sample was collected.

The lake appeared to have been limited by phosphorus during the first two lake sampling periods as indicated by nitrogen/phosphorus ratios of 21/1 and 20/1 at those times.

D. Trophic Condition

Survey data denote a mesotrophic condition. In most parameters measured, Mattawamkeag compares favorably with Long Lake, Aroostook County, and Long Lake, Cumberland County; i.e., nutrient and chlorophyll a concentrations were quite low. Some depression of dissolved oxygen was noted at station 2 in August 1972. Biologists with the State of Maine Departments of Environmental Protection and Inland Fisheries and Game support this conclusion.

V. NUTRIENT LOADINGS*
(See Appendix C for all data)

For the determination of nutrient loadings, from September, 1972, through August, 1973, the Maine National Guard collected monthly near-surface grab samples from each of the sites indicated on the map (page v), except for the high runoff months of April and May, when two samples were collected from most of the stations, and the colder months when one or more samples were not collected at several stations because of low flows or ice cover.

Stream flow estimates for the sampling year, and a "normalized" or average year, were provided for the inlet (A-2), outlet (A-1) and direct lake drainage (ZZ) by the Maine District Office of the U.S. Geological Survey through an interagency agreement (See Appendix A). The flows for Fish Stream (C-1), Upper Mattawamkeag River (A-3), Dyer Brook (B-1), and Sly Brook, as well as sampling sites C-3 and C-2, were estimated by determining the subdrainage areas in square miles by planimetry, adjusting the sum of these areas to equal the total drainage area calculated by U.S.G.S., and then multipling these adjusted areas, in mi^2, by the runoff coefficient per mi^2 used by the U.S.G.S. for calculating A-2 flows (see Appendix A for calculated flows).

In this report, tributary loadings were calculated using mean concentrations and mean flows. Nutrient loadings for unsampled Sly Brook and

* Based on sampling frequency and variations in concentrations, single tributary loadings for gaged sites are believed to be within ±16% of the true value 67% of the time and within ±32% of the true value 95% of the time.

"minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were calculated using the mean nutrient concentrations of Fish Stream at site C-3 and the estimated mean flows.

The untreated sewage discharges of Patten and Island Falls were not sampled during the Survey. Nutrient loads for these communities were derived by calculating the nutrient loads in the streams above and below these sources, and the differences in the loads were attributed to the point sources (e.g., the loads in Fish Stream at C-2 minus the Fish Stream loads at C-3 = Patten loads).

Although the phosphorus load estimated for Patten in this way appears reasonable compared to a per-capita estimate, the nitrogen load appears to be about eight times higher than expected on a per-capita basis. Survey information and data do not provide an explanation for the high nitrogen load.

In the case of Island Falls, both phosphorus (2.6 x per-capita estimate) and nitrogen loads (5.3 x per-capita estimate) are higher than expected. The differences are believed to be attributable to the potato processing plant in Island Falls.

A. Waste Sources:

1. Municipal -

Name	Pop. Served	Treatment	Mean Flow (mgd)	Receiving Water
Island Falls	800	None*	0.08**	West Branch, Mattawamkeag River
Patten	1,100	None*	0.11**	Fish Stream

2. Industrial -

Name	Product	Treatment	Mean Flow (mgd)	Receiving Water
Unknown	Potato processing (at Island Falls)	?	?	West Branch, Mattawamkeag River

* Both towns are sewered but have no treatment as yet.
** Estimated (100 g/per capita/day).

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
W. Br. Mattawamkeag River	3,420	19.1
Fish Stream	1,700	9.5
Dyer Brook	1,030	5.7
Sly Brook	820	4.6
b. Minor tributaries & immediate drainage (non-point load)* -	630	3.5
c. Municipal sources -		
Patten	2,480	13.8
Island Falls	7,350	40.9
d. Septic tanks - Unknown	?	
e. Industrial -		
Potato processing (At Island Falls)	?	
f. Direct Precipitation* -	520	2.9
Total	17,950	100.0

2. Outputs -

Lake outlet 12,390

3. Net annual P accumulation - 5,560 pounds

* Estimated; see Working Paper No. 1, "Survey Methods".

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/yr	% of total
a. Tributaries (non-point load) -		
W. Br. Mattawamkeag River	159,200	23.7
Fish Stream	201,180	30.0
Dyer Brook	83,030	12.4
Sly Brook	42,450	6.3
b. Minor tributaries & immediate drainage (non-point load)* -	32,680	4.9
c. Municipal sources -		
Patten	81,060	12.1
Island Falls	39,550	5.9
d. Septic tanks - Unknown	?	
e. Industrial -		
Potato processing (At Island Falls)	?	
f. Direct precipitation* -	32,080	4.7
Total	671,230	100.0

2. Outputs -

Lake outlet	509,000

3. Net annual N accumulation - 162,230 pounds

* Estimated; see Working Paper No. 1, "Survey Methods".

D. Mean Annual Non-point Nutrient Export by Sub-drainage Area:

Tributary	lbs $P/mi^2/yr$	lbs $N/mi^2/yr$
W. Br. Mattawamkeag River	28	1,283
Fish Stream	15	1,769
Dyer Brook	30	2,442
Sly Brook	37	1,912

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (1973). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	5.4	1.7	201.6	48.7
grams/m^2/yr	0.60	0.19	22.6	5.5

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Mattawamkeag Lake:

"Dangerous" (eutrophic rate)	1.00
"Permissible" (oligotrophic rate)	0.50

F. Controllability of Nutrients:

1. Discussion -

During the sampling year, Mattawamkeag Lake received an estimated total phosphorus load at a rate less than the

"dangerous" (eutrophic) rate but more than the "permissible" (oligotrophic) rate proposed by Vollenweider; i.e., a mesotrophic rate. Of this load, it is estimated that Patten contributed about 14%, and Island Falls contributed about 41%.

At this time, there are nine Maine communities with higher waste treatment plant construction priorities than Patten and Island Falls, and Matthew Scott of the Maine Department of Environmental Protection advises that the two communities probably will not be funded for preparation of plans for secondary treatment before FY 1977. In view of the existing mesotrophic loading rate, it seems likely that the trophic condition of Mattawamkeag Lake will not be changed appreciably in the intervening time.

In the following table, total phosphorus loadings that can be achieved by specific levels of phosphorus removal at the point sources of Patten and Island Falls (including the 25% removal expected of secondary treatment plants) are shown and compared to Vollenweider's suggested loading rates.

% P Removal	Total P Loading lbs/acre/yr	Total P Loading $g/m^2/yr$
Existing	5.4	0.60
25 (with secondary treatment)	4.7	0.52
50	4.0	0.45
70	3.4	0.38
80	3.1	0.35
100	2.6	0.29
Vollenweider:		
"Dangerous"		1.08
"Permissible"		0.54

It will be noted that when the secondary waste treatment facilities become operational, the loading rate to Mattawamkeag Lake will be reduced to less than an oligotrophic rate. It appears, therefore, that additional phosphorus removal at Patten and Island Falls will not be necessary, although it is recognized that the proportion of immediately-available orthophosphates will be markedly increased with secondary treatment.

VI. LITERATURE REVIEWED

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Scott, Matthew, 1974. Personal communication (trophic state and color of Mattawamkeag Lake; construction priorities). Dept. of Environmental Protection, Augusta.

Vollenweider, Richard A., 1973. Input-output Models. MS. Canada Centre for Inland Waters, Burlington, Ontario.

VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR MAINE 6/25/74

LAKE CODE 230M MATTAWAMKEAG LAKE

TOTAL DRAINAGE AREA OF LAKE 314.00

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
230MA1	314.00	265.00	183.00	383.00	1570.00	1180.00	398.00	185.00	141.00	171.00	268.00	626.00	437.00	484.12
230MA2	294.00	238.00	163.00	333.00	1490.00	1140.00	383.00	179.00	136.00	166.00	260.00	596.00	405.00	457.63
230MZZ	20.00	27.00	20.00	50.00	77.00	44.00	15.00	6.10	4.90	5.00	8.10	30.00	32.00	26.59

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 314.00
SUM OF SUB-DRAINAGE AREAS = 314.00

TOTAL FLOW IN = 5808.09
TOTAL FLOW OUT = 5807.00

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
230MA1	9	72	549.00	16	258.00				
	10	72	407.00	14	313.00				
	11	72	1250.00	4	1070.00				
	12	72	690.00	9	1060.00				
	1	73	448.00	6	309.00				
	2	73	595.00	3	857.00				
	3	73	1130.00	3	260.00				
	4	73	1960.00	7	1100.00	22	2720.00		
	5	73	1700.00	5	1510.00	19	1580.00		
	6	73	517.00	10	352.00				
	7	73	1040.00	14	489.00				
	8	73	1410.00	1	254.00				
230MA2	9	72	533.00	16	251.00				
	10	72	395.00	14	304.00				
	11	72	1190.00	4	1020.00				
	12	72	640.00	9	986.00				
	1	73	402.00	6	277.00				
	2	73	530.00	3	763.00				
	3	73	979.00	3	225.00				
	4	73	1860.00	7	1040.00	22	2590.00		
	5	73	1640.00	5	1460.00	19	1530.00		
	6	73	498.00	10	339.00				
	7	73	1010.00	14	475.00				
	8	73	1390.00	1	250.00				
230MZZ	9	72	16.00						
	10	72	12.00						
	11	72	60.00						
	12	72	51.00						
	1	73	46.00						
	2	73	65.00						
	3	73	147.00						
	4	73	96.00						
	5	73	63.00						
	6	73	20.00						
	7	73	34.00						
	8	73	49.00						

20

APPENDIX B

PHYSICAL AND CHEMICAL DATA

K - Value is less than indicated
J - Value known to be in error

STORET RETRIEVAL DATE 74/06/25

230801
45 57 27.0 068 09 06.0
MATTAWAMKEAG LAKE
23 MAINE

11EPALES 2111202
3 0015 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/06	11 50	0000	19.3	8.5	96	30	6.90	10K	0.040	0.050	0.013	0.006
	11 50	0006	18.2	8.0		30	6.90	10	0.060	0.050	0.006	0.005
	11 50	0014	17.0	7.6		30	6.80	11	0.040	0.050	0.006	0.005
72/08/08	12 55	0000			74	65	6.90	17	0.060	0.080	0.009	0.006
	12 55	0004	20.5	7.4		65	6.90	16	0.070	0.080	0.010	0.006
	12 55	0010	20.5	7.2		65	6.80	17	0.060	0.080	0.010	0.006
72/09/28	15 40	0000			62	65	7.18	25	0.030	0.060	0.014	0.010
	15 40	0004	14.3	9.7		63	7.10	25	0.030	0.080	0.021	0.010

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/06	11 50	0000	1.5J
72/08/08	12 55	0000	1.7J
72/09/28	15 40	0000	2.2J

STORET RETRIEVAL DATE 74/06/25

230802
45 59 00.0 068 10 00.0
MATTAWAMKEAG LAKE
23 MAINE

11EPALES 2111202
5 0028 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/06	13 00	0000	18.9	8.3	84	40	6.90	10K	0.040	0.040	0.013	0.006
	13 00	0015	16.6	7.3		20	6.60	10K	0.050	0.050	0.011	0.006
	13 00	0028	10.8	7.8		30	6.50	12	0.120	0.060	0.006	0.005
72/08/08	12 30	0000			36	65	6.90	15	0.060	0.070	0.010	0.007
	12 30	0004	20.5	7.6		65	6.90	15	0.060	0.070	0.009	0.006
	12 30	0010	20.4	8.0		65	6.90	15	0.060	0.080	0.010	0.007
	12 30	0015	20.4	7.6		65	6.80	16	0.050	0.070	0.012	0.006
	12 30	0020	20.3	7.6		63	6.70	16	0.060	0.070	0.010	0.007
	12 30	0025	20.2	7.6		65	6.70	15	0.060	0.080	0.011	0.008
	12 30	0028	18.9	3.4		65	6.40	16	0.080	0.100	0.012	0.008
72/09/28	15 10	0000			55	65	7.10	25	0.030	0.070	0.014	0.011
	15 10	0004	15.0	9.0		63	7.08	25	0.030	0.060	0.015	0.010
	15 10	0015	14.9	8.8		63	7.10	23	0.030	0.050	0.014	0.011
	15 10	0024	14.8	8.5		63	7.10	23	0.030	0.070	0.017	0.011

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/06	13 00	0000	2.0J
72/08/08	12 30	0000	2.0J
72/09/28	15 10	0000	2.7J

23

STORET RETRIEVAL DATE 74/06/25

230803
46 01 00.0 068 14 00.0
MATTAWAMKEAG LAKE
23 MAINE

11EPALES
5

2111202
0006 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/06	13 50	0000	19.3	7.8	66	40	6.80	12	0.050	0.060	0.011	0.005
	13 50	0006	19.4	8.8		40	6.80	13	0.050	0.040	0.009	0.005
72/08/08	12 10	0000			52	72	6.90	17	0.070	0.080	0.015	0.011
	12 10	0004	20.2	7.8		70	6.90	16	0.060	0.070	0.013	0.009
72/09/28	14 40	0000			36	68	7.20	23	0.040	0.110	0.017	0.012
	14 40	0002	13.5	9.1		65	7.15	22	0.030	0.090	0.018	0.012

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/06	13 50	0000	2.6J
72/08/08	12 10	0000	1.8J
72/09/28	14 40	0000	1.4J

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APPENDIX C

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

K - Value is less than indicated
J - Value known to be in error

STORET RETRIEVAL DATE 74/06/25

2308A1 LS2308A1
45 57 00.0 068 08 30.0
W BR MATTAWAMKEAG RIVER
23 15 MATTAWAMKEAG
0/MATTAWAMKEAG LAKE
W BANK 0.5 MI UPSTREAM OF BIBLE PT
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/16	14 00		0.071	0.650	0.112	0.010	0.014
72/10/14	13 00		0.036	0.350	0.100	0.005K	0.011
72/11/04	13 30		0.038	0.630	0.048	0.005K	0.015
73/03/03	13 00		0.250	0.230	0.016	0.006	0.015
73/04/22	12 00		0.198	0.310	0.018	0.006	0.010
73/05/05	14 00		0.080	0.270	0.010	0.005K	0.015
73/05/19	10 45		0.063	0.250	0.009	0.005K	0.010
73/07/14	12 35		0.033	0.520	0.031	0.005K	0.015
73/08/01	13 00		0.010K	0.780	0.031	0.005K	0.015

STORET RETRIEVAL DATE 74/06/25

2308A2 LS2308A2
46 00 00.0 068 15 00.0
W BR MATTAWAMKEAG RIVER
23 15 MATTAWAMKEAG
1/MATTAWAMKEAG LAKE
BANK 1 MI SE OF ISLAND FALLBELO STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/16	09	15	0.036	0.450	0.066	0.033	0.050
72/10/14	09	10	0.045	0.850	0.063	0.005K	0.012
72/11/04	11	45	0.160	1.000	0.042	0.005K	0.012
73/01/06	14	25	0.290	0.660	0.019	0.042	0.054
73/02/03	10	55	0.230	0.240	0.033	0.007	0.010
73/03/03	14	30	0.310	0.880	0.035	0.005K	0.015
73/04/07	10	00	0.240	0.260	0.005K	0.005K	0.010
73/04/22	10	15	0.180	0.780	0.028	0.010	0.010
73/05/05	09	30	0.099	0.200	0.008	0.005K	0.010
73/05/19	10	30	0.072	0.280	0.005K	0.005K	0.010
73/08/01	10	40	0.010K	0.270	0.020	0.005K	0.015

STORET RETRIEVAL DATE 74/06/25

2308A3 LS2308A3
46 00 30.0 068 16 30.0
W BR MATTAWAMKEAG
23 15 ISLAND FALLS
I/MATTAWAMKEAG
ST HWY 159 BRDG ABOV ISLAND FALLS STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/16	09 00		0.038	0.250	0.053	0.005K	0.010
72/10/14	09 30		0.062	0.250	0.075	0.005K	0.008
72/11/04	08 40		0.107	0.400	0.027	0.005K	0.011
72/12/09	11 00		0.240	0.220	0.016	0.005K	0.007
73/01/06	13 40		0.168	0.210	0.021	0.005K	0.005K
73/02/03	10 05		0.390	0.260	0.036	0.007	0.010
73/03/03	09 20		0.189	0.180	0.028	0.005K	0.010
73/04/07	09 45		0.120	0.360	0.010	0.005K	0.005K
73/04/22	09 40		0.115	0.920	0.034	0.006	0.010
73/05/05	09 05		0.048	0.160	0.011	0.005K	0.005K
73/05/19	14 00		0.048	2.200	0.066	0.005K	0.010
73/06/10	08 00		0.014	0.110	0.011	0.005K	0.010
73/08/01	10 25		0.010K	0.210	0.020	0.005K	0.015

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STORET RETRIEVAL DATE 74/06/25

2308B1 LS2308B1
46 00 30.0 068 15 30.0
DYER BROOK
23 15 ISLAND FALLS
T/MATTAWAMKEAG
US 2 BRDG E OF ISLAND FALLS
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/14	09 55		0.061	0.300	0.198	0.010	0.011
72/10/14	08 50		0.088	0.950	0.052	0.005K	0.009
72/11/04	08 30		0.247	1.260	0.046	0.005K	0.011
72/12/09	11 30		0.350	0.350	0.014	0.005K	0.020
73/01/06	14 05		0.370	0.217	0.020	0.005K	0.005K
73/02/03	10 23		0.300	0.265	0.029	0.005K	0.005K
73/03/03	09 30		0.440	0.160	0.019	0.005K	0.005K
73/04/07	10 25		0.300	0.220	0.005K	0.005K	0.005K
73/04/22	10 00		0.230	1.100	0.050	0.005K	0.015
73/05/05	09 45		0.160	0.440	0.037	0.005K	0.010
73/05/19	10 15		0.130	0.240	0.007	0.005K	0.005K
73/06/10	08 10		0.198	0.170	0.010	0.005K	0.015
73/07/14	11 25		0.126	0.480	0.028	0.005K	0.010
73/08/01	10 30		0.115	1.980	0.115		0.015

STORET RETRIEVAL DATE 74/06/25

2308C1 LS2308C1
46 01 00.0 068 17 00.0
FISH STREAM
23 15 ISLAND FALLS
T/MATTAWAMKEAG
ST HWY 159 BRDG NW OF ISLAND FALLS
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/14	09 35		0.143	1.050	0.078	0.005K	0.010
72/11/04	08 45		0.247	0.580	0.035	0.005K	0.011
73/01/06	12 30		0.390	0.340	0.023	0.005K	0.009
73/02/03	09 55		0.360	0.420	0.031	0.006	0.010
73/03/03	09 15		0.500	0.240	0.026	0.005K	0.010
73/04/07	09 30		0.390	0.220	0.005K	0.005K	0.010
73/04/22	09 35		0.260	0.690	0.021	0.005K	0.010
73/05/05	09 00		0.198	0.340	0.015	0.005K	0.010
73/05/19	15 45		0.132	1.100	0.027	0.005K	0.010
73/06/10	07 45		0.180	0.255	0.013	0.005K	0.020
73/08/01	10 20		0.060	0.390	0.034	0.005K	0.020

STORET RETRIEVAL DATE 74/06/25

2308C2 LS2308C2
46 00 00.0 068 25 30.0
FISH STREAM
23 15 SHERMAN
T/MATTAWAMKEAG
RD S FROM ST HWY 159 BELO PATTON WST DSC
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/16	10 45		0.580	0.550	0.040	0.024	0.039
72/10/14	10 10		0.351	0.550	0.113	0.011	0.020
72/11/04	09 05		0.312	0.920	0.037	0.006	0.019
72/12/09	10 00		0.450	0.420	0.020	0.005K	0.022
73/01/06	11 30		0.560	1.430	0.034	0.013	0.037
73/02/03	09 20		0.390	1.050	0.038	0.010	0.040
73/03/03	08 45		0.720	0.220	0.013	0.006	0.015
73/04/07	08 45		0.660	0.240	0.006	0.006	0.040
73/04/22	09 10		0.360	0.670	0.017	0.010	0.035
73/05/05	08 30		0.340	0.280	0.011	0.005K	0.015
73/05/19	09 25		0.260	0.970	0.007	0.005K	0.015
73/06/10	07 30		0.280	0.260	0.012	0.005K	0.035
73/07/14	10 55		0.550	0.520	0.036	0.007	0.025
73/08/01	10 00		0.580	0.720	0.052	0.009	0.035

STORET RETRIEVAL DATE 74/06/25

2308C3 LS2308C3
45 59 30.0 068 27 00.0
FISH STREAM
23 15 SHERMAN
T/MATTAWAMKEAG
0.33 MI W OF PATTEN ABOV PATTEN WST DISC
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/16	13 32		0.078	0.300	0.073	0.005K	0.008
72/10/14	10 45		0.117	0.400	0.091	0.005K	0.009
72/11/04	09 25		0.150	0.310	0.025	0.005K	0.010
72/12/09	08 30		0.180	0.220	0.012	0.005K	0.009
73/01/06	10 10		0.220	0.310	0.007	0.005K	0.014
73/02/03	08 55		0.170	0.440	0.031	0.007	0.017
73/03/03	08 30		0.330	0.230	0.024	0.005K	0.010
73/04/07	08 00		0.210	0.460	0.016	0.005K	0.010
73/04/22	08 55		0.160	1.540	0.029	0.005K	0.015
73/05/05	08 00		0.080	0.640	0.015	0.006	
73/05/19	09 30		0.066	0.940	0.006	0.005K	0.015
73/06/10	07 10		0.091	0.190	0.007	0.005K	0.015
73/08/01	09 45		0.036	0.250	0.023	0.005K	0.015